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Climate change and effect on income in Danish Agriculture

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Abstract

Climate change will increase yields in crop production by 10-20% and income in the Danish agricultural sector by 200-400 million € per year. The land which is taken out of production, due to higher water levels, will probably be limited until 2050. The society gain will be smaller than the sector gain as the climate change will result in increased loss of e.g. nitrogen and higher use of pesticides. The Danish agricultural sector has reduced CO_2 emissions by 25%, but further decreases will be required.

Introduction

Analyses of the economic impact of climate change suggests that this will lead to a reduction in national income in the southern part of Europe, whereas is might lead to increases in income in Scandinavia and Canada. Analyses also suggest that reducing the CO_2 emissions by 25-70% will be required to reach the target increase of 2-3°. The costs would be a reduction in the Gross Domestic Product (GDP) of 0.1% annually. Although this is a limited cost, the implication is that the economic burden of climate change will be distributed very differently between countries and regions.

Globally, the potential for food production is projected to increase with raising temperature of 1-3°, however, above this level, a decrease is projected (IPCC-may 2007).

The analyses also suggest that agriculture in the poorest countries will not, as in previous cases, be able to maintain the income level as it will be severely affected. For the Nordic countries the climate change is expected to increase summer temperatures and winter precipitation. It is not easy to estimate the economic consequences, but some preliminary results regarding both mitigation and adaptation are presented here.

Heat wave in Europe in 2003

The heat wave and drought which hit Southern and Central Europe in 2003 affected also agriculture severely. The total loss in EU was around 10%, but some countries and productions were much more affected (see fig. 1). The total agricultural loss for the selected countries is estimated to more than 11 billion €. The loss is mainly related to arable production, but also the animal sector had a significant loss (beef and poultry).

Yields

It is assumed that the higher CO_2 concentration together with higher temperatures will increase crop yields by 10-20%. For winter wheat the increase might be higher, but for other crops higher summer temperatures will lead to lower yields as the crops will have shorter time to develop.

Fig. 2. Farming with more water

The effect of higher yields in Scandinavia on world crop prices is difficult to predict as the yields in other parts of the world will decrease. However, changes in temperature could lead to changes in crops and crop rotations with the introduction of more profitable crops like grain maize and wine in Denmark.

An increase in yields in Denmark of 10-20 pct. will increase agricultural turn over by 230-450 million € per year. The increase requires more use of nitrogen and pesticides, but the net gain will still be substantial.

The increased yield in grass production will reduce the need for concentrates, but summer grazing might be more difficult to maintain in dry years. Just as the income from grass seed production might increase a little. Clim
ate change will have a positive effect on the income in dairy farming.

The need for irrigation might also increase, but shortage of drinking water in the eastern part of Denmark will limit the use of irrigation here.

Other impacts

The production of vegetables, fruit and berries as well as the green house production is expected to increase. The costs of heating green houses is expected to decline, which together with higher yields will decrease costs per produced unit .

The indoor animal production (mainly pigs) will need more water and more room will be required to cope with the higher temperatures.

More extreme weather patterns would imply more incidents of high intensity rain and flooding as well as extended periods of drought.

Aims to further decrease Nitrogen leaching and limits on pesticide use will reduce the potential gain for Danish Agriculture from climate change.

Environmental impact

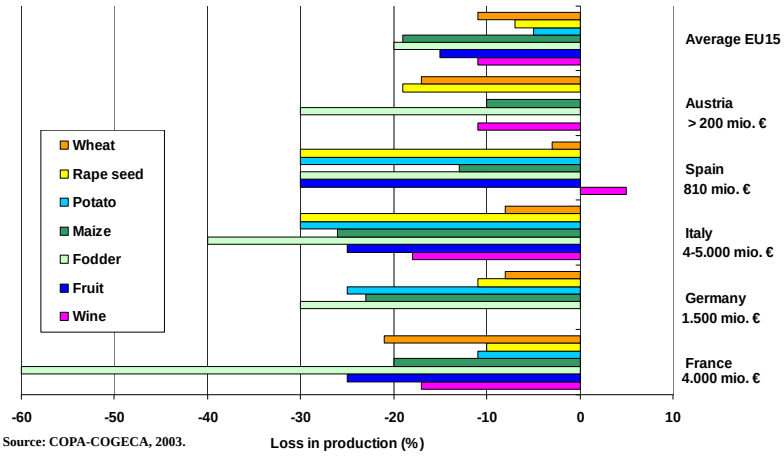
Increases in temperature and potential yield levels will also increase the optimal nitrogen (N) application. If higher N-applications are allowed, this will lead to increases in N-leaching, although a better crop N-efficiency is expected over time. Furthermore, it is expected that the higher sea temperature will make the sea more vulnerable to nitrogen losses from land, which would require further reduction of the acceptable nitrogen loss in order to obtain a given water quality, e.g., as defined in the Water Framework Directive.

Warmer climate and more precipitation will also increase the amount of required pesticides, which is not in line with the Danish pesticide programme, where a reduction of 20%, measured by the treatment frequency index, is agreed. This might lead to a re-assessment of the Danish Pesticide Plan targets. With unchanged environmental targets it seems likely that only part of the potential climate change gain can be achieved.

Reduced area

It is likely that the increased precipitation will lead to more land being taken out of production. Owners of land which is flooded a large part of the year will no longer qualify for the single payment scheme for these areas but might be able to sell their rights to other farmers. It is not clear how large an area that will be taken out of production in case the sea level increases by, e.g., 50 cm. Some analyses suggest that the effect might be in the order of 30-50.000 ha (less than 2%).

Fig.1. Changes in agricultural production and economic loss in Southern Europe in 2003



Source: COPA-COGECA, 2003.

Income change at society level

Increases in yields of 10-20% will increase turn over from the crop production by 230-450 million € in Denmark. Higher nitrogen and pesticide use will increase costs, but an increase in income is expected.

A reduced agricultural area will lead to private income loss, but for the society it might be a gain as the benefits from reductions of nutrient and CO_2 losses from these areas might be higher than the income losses. The low areas near streams might be taken out of production due to climate change, but it might also be the most economical areas to take out of production in order to reach the targets of the Water Framework Directive. It is seems important to think of synergies where changes might help to fulfil other objectives.

It seems likely that climate changes will effect agriculture positively with regard to sector as well as societal perspectives. This conclusion is in line with analyses of the socio economic impact of climate change on agriculture in Finland.

Mitigation

Danish Agriculture will probably have reduced its CO_2 emissions by 25 percent from 1990 to 2010, but further reductions will be required. The emissions from agriculture are mainly methane and nitrous oxide, constituting around 90% of the total emission.

The CO_2-reductions in Danish agriculture are linked to the Aquatic Programme I – III and reductions in livestock (cows).

Analyses of the future measures suggest that, e.g., changes in feeding practices will be required. Increased use of energy crops and biogas is another way forward. Agriculture might also be able to increase soil carbon sinks.

Projections indicate a further reduction of 17% in CO_2 emissions from Agriculture from today until 2030 (Illerup et al., 2007).

Conclusion

Agriculture in Northern Europe is likely to gain from climate changes. The effects will be higher yields and new crops, but also reductions in agricultural area near streams and rivers.

Agriculture will have to adapt to these changes which are already under way. The Agricultural sector will also have to introduce new measures which can further reduce CO_2-emissions from agriculture

As for many other sectors, it is not a question of either adaptation or mitigation since both will be required.

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